

**John M. Guynn**

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**From:** Randy Smith [rsmith@earthshell.com]  
**Sent:** Saturday, September 17, 2005 6:08 PM  
**To:** John M. Guynn  
**Subject:** FW: REVIEW: Wrap Model  
**Importance:** High  
**Attachments:** Wrap Model - Rev 003 022001.xls

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**From:** Matt Loos  
**Sent:** Sunday, February 25, 2001 12:07 PM  
**To:** Donna Balinkie; Kishan Khemani; Randy Smith  
**Cc:** Matt Loos; Scott Houston  
**Subject:** REVIEW: Wrap Model  
**Importance:** High

Folks,

Please find attached the latest Wrap Model for INTERNAL review. This latest version requires a detailed review by those to whom this e-mail is addressed. Ideally, we would be face-to-face for this review, but there may be some tweaks to make before that session occurs this week. I welcome all input.

- 1) The Wrap model now contains a fairly exhaustive Assumptions tab. The Assumptions tab is the **ONLY** input area, and maintains all assumptions that drive the 'BioWrap' tabs. Please review for format and accuracy of assumptions
  - a) **For BioWrap A**, I've changed the assumption for the ratio of Biomax/EcoFlex from 80/20 to 20/80. This was changed once the formulae for the Formulation section were improved (see Note 4) and effectively showed that there was not enough Ecoflex raw material to feed both the Masterbatch compounding and final compounding requirements. **Kishan** - I worked through these original assumptions with you. I may have transposed them incorrectly from the beginning, but nevertheless, I need you to verify and sign-off on the Raw Material and Formulation percentages presented in this version.
- 2) Per Scott's request, I have procured the Bioplast formulations from Biotec. This is **VERY SENSITIVE** data and was provided to me after I assured Harald that I would keep this information strictly confidential. Please help me retain my integrity and inside relationship with Biotec by exercising extreme caution with this information. Please do not share this information outside of our internal Wrap project team, i.e. those to whom this e-mail is addressed.
- 3) By understanding Biotec's formulation, I have now been able to compare the BioWrap A and G on an equal basis, when evaluating the economics of the Target - High Commercial Volume case. This information has allowed the model to demonstrate that, on Raw Material cost alone, these two wraps have similar economics.
- 4) The formulae for each BioWrap's Formulation section were improved in order to accept the detailed Bioplast formulation (The previous model version used an inherently limiting logic to drive the Raw Materials from the Formulation assumptions; This current version's logic more appropriately drives the Formulation from the Raw Material assumptions). Although BioWrap A does not use the Bioplast material, I wanted both comparisons (A & G) to treat the Formulation section in the same manner. This led to a fairly intense (IMHO) matrix to clearly show how a set of raw materials is compounded into masterbatches and then compounded again into the final resin to be blown. This matrix for both BioWrap A and G can be found on the "REF. ONLY - Calc" tab. This tab details the same calculations used on the 'BioWrap' tabs to derive the Formulation section.
  - a) There is probably a better way to present how the Formulation percentages are calculated. The formulae are themselves not intense, but I believe the logic requires some 'quiet time'. I would like your review and input.
- 5) **Kishan/Randy** - I want to make absolutely sure that I have properly represented the raw materials relative to the masterbatches. For instance, does the "Whitener - TiO2" raw material truly relate to the "Ecoflex / 64% TiO2/BaSO4"

9/19/2005

masterbatch?

Please note that all improvements to the model have focused on the BioWrap A & G ONLY. Hence, tabs not addressed are prefaced by a "NOT USED" in the tab names. I will return to the other samples (if need be) after we have collectively 'nailed' the format, etc for BioWraps A & G.

Thank you very much for your support and constructive criticism to improve the accuracy and usefulness of the Wrap Model.

Take Care,  
Matt

9/19/2005

**EarthShell Corporation**  
**Biodegradable Wrap Model**

**BioWrap G (ES #2), printed, paper-like tissue, 30 micron**

**Bioplast 105/30/W20, 3% SiO2, 3% TiO2, 22% CaCO2 filled, plain, paper-like tissue, 30 micron  
15" x 15"**

	Weight Mix ratios Fin. Prod.	Mstr Batch mat req'd g/piece	Minimum Commercial Volume		High Commercial Volume		
			Price/LB Cost/1000	Future \$	Price/LB Cost/1000	Target \$	
Raw Materials:							
Bioplast GF 105/30/W20:							
Ecoflex FBX	47.53% (a)	1.18	(b)	2.63	0.97	4.28	
PLA	20.37% (a)				1.40	2.64	
Loxamid	0.23% (a)				2.49	0.05	
Loxoid	0.23% (a)				1.13	0.02	
K21	0.23% (a)				2.43	0.05	
Masterbatch white	5.43% (a)				1.90	0.60	
Anti-block - SiO2	3.00% (a)				0.14	0.04	
Whitener - TiO2	3.00% (a)				0.89	0.28	
Inorganic Filler - CaCO3	22.00% (a)				0.09	0.18	
Raw Materials	100.00%	1.18		2.63		8.15	
Formulation:							
Masterbatch Compounding:							
Bioplast GF 105/30/W20	50.3%	2.11	(b)	7.39	0.00	0.00	
Ecoflex / (Assume) 60% SiO2	5.0%	0.21	(b)	0.69	0.00	0.00	
Ecoflex / 64% TiO2/BaSO4	4.7%	0.20	(b)	0.72	0.00	0.00	
Ecoflex / 55% CaCO3	40.0%	1.68	(b)	5.37	0.00	0.00	
Formulation	100.0%	4.20		14.17		0.00	
Combined film converting process							
		4.20		0.00	0.30	2.78	
Separate converting processes							
Blowing:		4.20		3.33	0.00	0.00	
Gemini							
Slitting:				0.00	0.00	0.00	
Gemini							
Printing:				0.00	0.00	0.00	
No							
Embossing:				0.00	0.00	0.00	
No							
Sheeting:				0.00	0.00	0.00	
Associated							
Separate converting processes							
				7.08		0.00	
Cost of Manufacture				23.88		10.93	
Markup	30%			7.16		3.28	
Target Selling Price				31.05		14.21	

Notes:  
(a) Used for calculating High Commercial Volume cost per 1000, i.e. single compounding step.  
(b) Used for calculating Minimum & Current Commercial Volume cost per 1000; ie dual compounding step.

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## Biodegradable Wrap Model

### Check Formulation Calculation

#### BioWrap A

	Biomax 6926	Ecoflex FBX	Anti-block - SiO2	Whitener - TiO2	Inorganic Filler - CaCO3
1	13.40	53.60	3.00	5.00	25.00
2	-3.00	-23.27	-3.00	-5.00	-25.00
3	10.40	30.33	0.00	0.00	0.00

#### BioWrap G

	Bioplast GF 105/30/W20	Anti-block - SiO2	Whitener - TiO2	Inorganic Filler - CaCO3
1	72.00	3.00	3.00	22.00
2	-21.69	-3.00	-3.00	-22.00
3	50.31	0.00	0.00	0.00

#### Bioplast GF 105/30/W20

	Ecoflex FBX	PLA	Slipping Agent	Loxamid	Loxiol
1	0.6601	0.2829	0.0094	0.0031	0.0031
1a	47.5272	20.3688	0.6768	0.2233	0.2233
2	-21.6875				
	25.8397	20.3688	0.6768	0.2233	0.2233

	0.5	0.64	0.55	
Biomax / 50% SiO2	Ecoflex / 64% TiO2/BaSO4	Ecoflex / 55% CaCO3	Total	
	0.00	0.00	0.00	100.00
	6.00	7.81	45.45	0.00
	6.00	7.81	45.45	100.00

	0.6	0.64	0.55	
Ecoflex / (Assume) 60% SiO2	Ecoflex / 64% TiO2/BaSO4	Ecoflex / 55% CaCO3	Total	
	0.00	0.00	0.00	100.00
	5.00	4.69	40.00	0.00
	5.00	4.69	40.00	100.00

K21	Masterbatch white		Total	
	0.0031	0.0476		1.00
	0.2233	3.4272		72.00
				-21.69
	0.2233	3.4272	0.0000	50.31

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## Biodegradable Wrap Model

### Material & Process Pricing

Description	Low Volume		Minimum Commercial Volume		High Commercial Volume		Notes:
	Current	Future	Future	Target	Target		
Inorganics - \$ per pound							
Talc - SiO2	0.14	0.14	0.14	0.14	0.14	Verified with Randy	
Whitener - TiO2	0.99	0.99	0.99	0.99	0.99	Verified with Randy	
Limestone - CaCO2	0.09	0.09	0.09	0.09	0.09	Verified with Randy	
Resin - \$ per pound							
Biomax 6926 - DuPont (Rigid)	1.20	1.00	1.00	1.00	1.00	Target price assumes compounding cost included.	
Ecoflex FBX - BASF (Flexible)	1.23	1.01	1.01	0.97	0.97	\$1.20 provided by Simon based upon talks with Dupont 5.80DM/kg up to 8,000 tons; 4.80DM<->4.60DM/kg up to 30,000 tons	
Masterbatch Compounding by Biotec - \$ per pound							
						7.50DM/kg for Low and Minimum Commercial = 6.0DM Raw Mat. + 1.5DM Compounding 6.00DM/kg for High Commercial = 4.5DM Raw Mat. + 1.5DM Compounding	
Bioplast GF 105/30/W20	1.59	1.59	1.59	1.27	1.27		
Masterbatch Compounding by Techmer PM - \$ per pound						Masterbatch compounding costs will remain relatively high without competition	
**applies to masterbatch only**	1,000 lbs	40,000 lbs					
Ecoflex / 55% CaCO3	1.85	1.45					
Ecoflex / 64% TiO2/BaSO4	2.05	1.65					
Ecoflex / (Assume) 60% TiO2	1.90	1.50					
Biomax / 61% CaCO3	1.90	1.50					
Biomax / 53% TiO2/BaSO4	2.10	1.70					
Biomax / 50% SiO2	2.02	1.62					
Process - \$ per pound							
Combined in-line (DuPont? BASF?)				0.30		Cocktail produced at primary, but not blown.	
Blowing - \$ per pound							
Gemini Plastics	0.36	0.36	0.36				
Transamerica Plastics	0.52	0.32	0.32				
Polymer Packaging	0.35	0.32	0.32				
Casting - \$ per pound							
Not Considered						Current Future	
Sifting - \$ per 1000						Given: \$36/hr or \$0.60/min. Assume 150 #/min or 3600 in/min. Assume: 15"x15" part.	
Gemini Plastics	0.18	0.18	0.18			Given: \$36/hr or \$0.60/min. Assume 300 #/min or 3600 in/min. Assume: 15"x15" part.	

Transamerican Plastics	0.33	0.33	Assume: 45" machine or 3 parts wide. So:3600 / 15 = 240 parts/min. So: 240 x 3 = 720 parts/min. So:1.0833 / 720 = \$0.0015/part Given: \$65/hr or \$1.0833/min. Assume:300 ft/min or 3600 in/min. Assume: 15"x15" part. Assume: 45" machine or 3 parts wide. So:3600 / 15 = 240 parts/min. So: 240 x 3 = 720 parts/min. So:1.0833 / 720 = \$0.0015/part
Printing - \$ per 1000			
Transamerican Plastics	2.90	2.90	Given: \$125/hr or \$2.0833/min. Assume:300 ft/min or 3600 in/min. Assume: 15"x15" part. Assume: 45" machine or 3 parts wide. So:3600 / 15 = 240 parts/min. So: 240 x 3 = 720 parts/min. So:2.0833 / 720 = \$0.0029/part Given: \$120/hr or \$2.00/min. Assume:300 ft/min or 3600 in/min. Assume: 15"x15" part. Assume: 45" machine or 3 parts wide. So:3600 / 15 = 240 parts/min. So: 240 x 3 = 720 parts/min. So:2.00 / 720 = \$0.0028/part
Associated Polybag	2.80	2.80	
Embossing - \$ per 1000			
Gemini Plastics	1.00	1.00	Given: \$45/hr or \$0.75/min. Assume:300 ft/min or 3600 in/min. Assume: 15"x15" part. Assume: 45" machine or 3 parts wide. So:3600 / 15 = 240 parts/min. So: 240 x 3 = 720 parts/min. So:0.75 / 720 = \$0.001/part Given: \$37/hr or \$0.6167/min. Assume:300 ft/min or 3600 in/min. Assume: 15"x15" part. Assume: 45" machine or 3 parts wide. So:3600 / 15 = 240 parts/min. So: 240 x 3 = 720 parts/min. So:0.6167 / 720 = \$0.0009/part
Transamerican Plastics	0.90	0.90	
Sheeting - \$ per 1000			
Transamerican Plastics	5.10	5.10	Given: \$37/hr or \$0.6167/min. Assume:120 parts/min. So:0.6167 / 120 = \$0.0051/part Sheeting's limiting factor is 'catching' the sheeted wraps as they come off of the machine, i.e. manual limitation
Freight - \$ per pound fob Primary Source	0.05	0.05	0.05

**EarthShell Corporation**  
**Biodegradable Wrap Model**

**BioWrap B, clear, 37 micron**

Ecomax 20/80, 5% SiO2, clear, 37 micron  
 15" x15"

	Weight Mix ratios Fin,Prod.	mat req'd g/piece	Minimum Commercial Volume		High Commercial Volume	
			Price/LB	Cost/1000	Price/LB	Cost/1000
Raw Materials:						
Biomax 6926	(a)	0.31 (b)	1.00	0.67	1.00	0.67
Ecoflex FBX	(a)	0.00 (b)	1.01	0.00	0.97	0.00
Total Raw Materials		0.31		0.67		0.67
Formulation:						
Biomax 6926	70.0%	4.27 (b)	1.00	9.41	1.00	9.41
Ecoflex FBX	20.0%	1.22 (b)	1.01	2.73	0.97	2.62
Masterbatch Compounding:						
Biomax / 50% SiO2	10.0%	0.61 (b)	1.45	1.95	0.00	0.00
Total Formulation	100.0%	6.10		14.09		12.03
Combined film converting process		6.10	0.00	0.00	0.30	4.03
Separate converting processes						
Blowing:						
Gemini		6.10	0.36	4.84	0.00	0.00
Slitting:						
Gemini				0.18		0.00
Printing:						
No				0.00		0.00
Embossing:						
No				0.00		0.00
Sheeting:						
Transamerican				5.10		0.00
Separate converting processes				24.89		16.74
Cost of Manufacture				39.65		33.47
Markup	30%			11.90		10.04
Target Selling Price				51.55		43.51

Notes:

- (a) Used for calculating High Commercial Volume cost per 1000; i.e. single compounding step.  
 (b) Used for calculating Minimum & Current Commercial Volume cost per 1000; ie dual compounding step.



# EarthShell Corporation Biodegradable Wrap Model

## BioWrap C, printed, 25 micron

Bioplast 105/30/W20 Carl's Jr. print, 25 micron  
14" x 14"

Raw Materials:	Weight Mix ratios Fin.Prod.	mat req'd g/piece	Minimum Commercial Volume		High Commercial Volume	
			Price/LB	Cost/1000	Price/LB	Cost/1000
			\$	\$	\$	\$
	(a)	0.00 (b)	0.00	0.00	0.00	0.00
	(a)	0.00 (b)	0.00	0.00	0.00	0.00
Total Raw Materials		0.00		0.00		0.00
Formulation:						
Masterbatch Compounding:						
Bioplast GF 105/30/W20	100.0%	5.00 (b)	1.59	17.48	1.27	13.98
		0.00 (b)	0.00	0.00	0.00	0.00
		0.00 (b)	0.00	0.00	0.00	0.00
Total Formulation	100.0%	5.00		17.48		13.98
Combined film converting process		5.00	0.00	0.00	0.30	3.31
Separate converting processes						
Blowing:		5.00	0.36	3.97	0.00	0.00
Slitting:						
Gemini				0.18		0.00
Printing:				0.00		0.00
No				0.00		0.00
Embossing:				0.00		0.00
No				5.10		0.00
Sheeting:						
Transamerican						
Separate converting processes				26.72		17.29
Cost of Manufacture				44.20		34.58
Markup	30%			13.26		10.37
Target Selling Price				57.46		44.95

Notes:

- (a) Used for calculating High Commercial Volume cost per 1000; i.e. single compounding step.  
(b) Used for calculating Minimum & Current Commercial Volume cost per 1000; ie dual compounding step.